

URBAN BIODIVERSITY MEADOWS: A TOOL FOR RESEARCH AND EDUCATION

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Abstract

The current state of grasslands in urban environments is becoming increasingly inadequate in terms of functionality. These grasslands fail to provide space for biodiversity, become dysfunctional in the summer months due to improper management, and their aesthetic value is largely diminished. One potential solution to improve the quality of life in cities, enhance the aesthetic appeal of public spaces, and support biodiversity is the introduction of flowering meadows in urban areas. In 2023, a project focusing on the education and research of flowering meadow communities was implemented on the SPU Campus. Traditional grasslands were replaced with biodiversity meadows that emphasize the regionality and originality of seed species. These permanent meadow communities are designed to improve filtration, hygiene, microclimate, ecological diversity, thermal regulation, and aesthetic value on the university campus. Additionally, sections of the meadow will be used for teaching and research purposes. The goal of the project is to raise awareness, promote environmental consciousness, advocate for sustainable solutions, and demonstrate them in practice.

Key words: enviromental, landscape architecture, urban area, city

Introduction

In urban areas, there is an increasing demand for green spaces, with both the ecological quality and quantity of these areas being crucial. Urban green spaces significantly enhance biodiversity within cities (Akbari, Pomerantz, Taha, 2001, Aronson et al., 2014, Rózová, Tóth, Pástorová, 2021). Short-mown grasslands, commonly designated for recreational use, are the dominant form of urban green spaces in temperate regions. However, they require intensive maintenance and typically provide limited habitat value for most species (Norton et al., 2019). As urbanization continues to grow globally, the role of cities in safeguarding and providing ecosystem services is becoming increasingly important (Seto et al., 2012). The potential for these services is often hindered by the absence of functional green spaces or by intensive maintenance practices that reduce biodiversity. Incorrect management of urban green spaces can negatively impact or even destroy the ecosystem functions these spaces provide. Remnants of semi-natural grasslands in urban areas also become excessively fragmented and isolated or totally lost (Manninen, Forss, Venn, 2010).

One key element of vegetation where proper maintenance management is crucial is grasslands, which constitute the largest proportion of urban vegetation. Short-mown urban grasslands are popular due to their perceived aesthetic value, well-established management protocols, provision of recreational space, and adherence to social norms (Harris, 2013, Norton et al., 2019). However, these areas require frequent mowing—5 to 8 times per season, with recreational lawns being mowed 10 to 12 times per growing season. An effective alternative for creating green spaces is the establishment of meadows with a diverse range of plant species. These meadows offer numerous benefits, including supporting pollinator conservation, improving air and water quality, and enhancing biodiversity. As such, the creation of wildflower meadows is an essential aspect of urban ecology (Rózova, Pástorová, Kuczman, 2023; Paudel, States, 2023; Tóth, 2023). They are often promoted as part of offsetting schemes, nature recovery plans, and city greening initiatives (Marshall, 2023).

A scientific and educational platform was established on the campus of the Slovak University of Agriculture in Nitra in 2023 and 2024 (Figure 1). This platform showcases various methods for managing herbaceous communities that could potentially be integrated into urban environments.

Materials and methods

For testing various meadow mixtures, an area at the Slovak University of Agriculture in Nitra was selected, with a total area designated for sowing of 11.000 m². The area was divided into several segments based on pedological and floristic surveys of the original vegetation and the analysis of solar radiation. The light conditions were primarily influenced by the vegetation in the area.

The selected areas for sowing the meadow mixtures are located along a transportation corridor that runs through the entire university campus.

A total of 12 mixtures were chosen, with each segment sown according to the analyses of light, soil, and the original vegetation. The area sizes and their locations within the campus are shown in Fig. 2 and Tab. 1.

In October 2023, the preparation of the areas for sowing began: intensive mowing to suppress the existing vegetation, mechanical soil disturbance, stone collection, leveling of uneven terrain, and depression filling.

In the following year, before sowing, the soil was prepared by tilling and harrowing. The sowing was done manually with seed rates of 5 g/m² and 10 g/m², followed by rolling the areas.

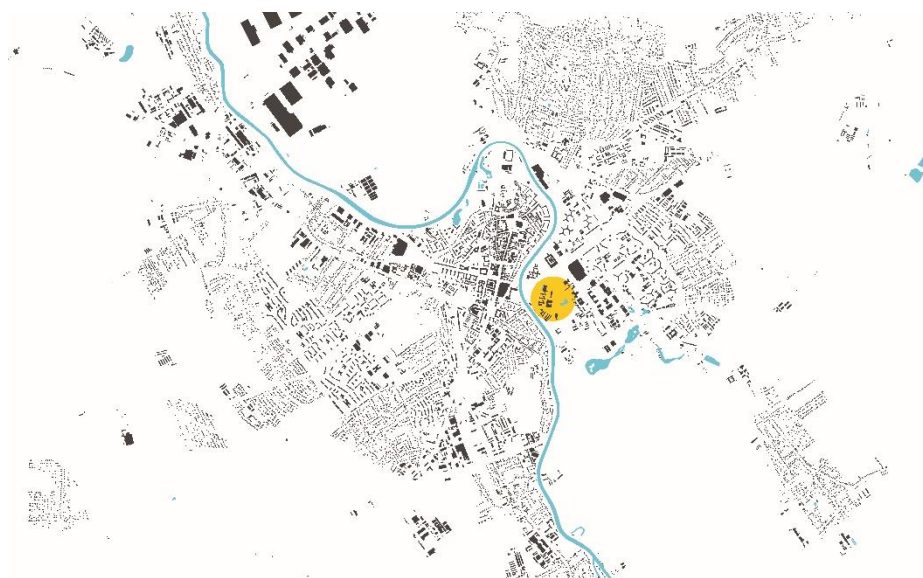


Fig. 1: Location of experimental meadow vegetation in the city of Nitra (Marek Hus, 2025).

The aim of the research activity is to assess the impact of selected factors on both qualitative (germination speed, meadow establishment in the year of sowing, density, color, health condition, persistence, aesthetic value) and quantitative (growth height before mowing, above-ground and below-ground biomass production) parameters of meadow communities. During two growing seasons (2024 and 2025), meadow communities will be evaluated based on the following:

- The impact of mowing frequency on meadow vitality, biodiversity, and the local microclimate will be observed.
- The effect of seed sowing rate (seeds per m²) in selected mixtures will be monitored, as well as its influence on both qualitative and quantitative parameters.
- The impact of applied fertilization and soil conditioners on the growth and development of meadow communities will be evaluated.
- The representation of selected species of flowering herbs will be assessed according to Tansley's scale.

Additionally, the economic efficiency of the meadow management technologies used will be monitored and evaluated.

Tab. 2: Meadow mixtures used within the segments and the area of the plots where they were applied.

segment	code	models/mixture	m ²
1	1 MBG	Mixture Botanic Garden	2890
2	2 Pa	Papilio®	660
	2 Ne	Nektár®	600
	2 Ru	Rusalka®	610
3	3 Slu	Slunovrat®	525
	3 Pa	Paprsek®	983
	3 Kr	Kráska®	1312
4a	4a Ka	Karneval®	630
	4a Kr; 4a Br	research area Krasohled®/Bromion®	1220
4b	4b Ro	Rondel®	310
	4b Ji	Jitřenka®	295
	4b Pa	Papilio®	310
5	5 Ro	Rondel®	600

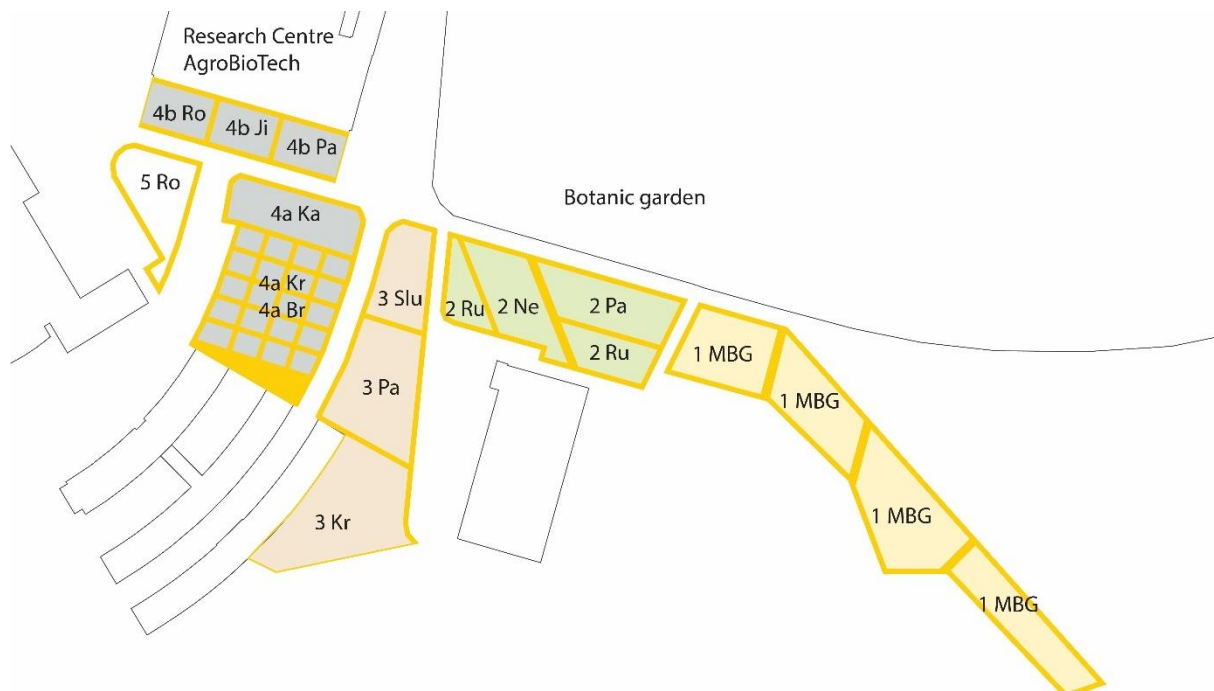


Fig. 2: Localization of segments within the SUA Campus (Marek Hus, 2025).

Results and Discussion

The aim was to use a wide range of mixtures that are available on the market in the Central European context and are utilized by landscape architects in designing landscape-architectural projects in urban environments. Designers, contractors, green space managers, as well as students and educators, have the opportunity to observe the development of various meadow mixtures—their growth dynamics, flowering effects, evolution over time, and the impact of mowing or fertilization on the vegetation. At the same time, the meadows are accessible to the general public (presented in Fig. 3). The variability in the establishment of these areas is a necessary input for further scientific research on the influence of unmown diverse meadow communities in urban environments, as well as their continued observation and evaluation of results. A demonstration beehive, complemented by a monitoring system, has been built directly on the meadow areas to showcase the importance of insects in the life cycle.

Several weeks after sowing, the vegetation was dense, and most species were identified in each segment through floristic surveys. The mixtures were treated with mowing twice during the season, in July and October. A few weeks after sowing, annual or perennial weeds (e.g., *Polygonum aviculare*, *Taraxacum officinale*) appeared in the vegetation, which should be suppressed as the vegetation develops.

In the first year, mixtures containing annual plants (Rondel, Karneval, Nektar) were aesthetically dominant. The effect of the flowering annual herbs was utilized while the perennial herbs were still developing, which increased the aesthetic value of the area (Dunnett, Hitchmough, 2007; Dunnett, 2011).



Fig. 3: Flowering biodiversity meadows on the SUA campus. View of the research area (left) and view of the MBG mixture (right) (Martin Havran, 2024).

Conclusion

The meadows on the university campus have proven to be an excellent resource for educating both professionals and the general public about the design and management of urban vegetation. In the first year, all twelve mixtures were introduced, accompanied by an analysis of how mowing impacts their vitality. The anticipated results will primarily provide valuable insights into the development of meadow communities during the first two growing seasons, as the vegetation becomes established. Based on these findings, rationalization measures for managing meadow communities—particularly in public green spaces—can be developed. Implementing these measures could reduce the frequency of labor-intensive interventions, thus lowering the overall cost of maintenance.

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Souhrn

Současný stav travnatých ploch v městském prostředí je z hlediska funkčnosti stále nevyhovující. Tyto travnaté plochy neposkytují prostor pro biodiverzitu, v letních měsících se stávají nefunkčními kvůli nevhodnému obhospodařování a jejich estetická hodnota je do značné míry snížena. Jedním z možných řešení, jak zlepšit kvalitu života ve městech, zvýšit estetickou přitažlivost veřejných prostranství a podpořit biodiverzitu, je zavedení květnatých luk v městských oblastech. V roce 2023 byl v areálu SPU realizován projekt zaměřený na vzdělávání a výzkum společenstev květnatých luk. Tradiční travní porosty byly nahrazeny biodiverzními loukami, které kladou důraz na regionalitu a originalitu semenných druhů. Tato trvalá luční společenstva mají zlepšit filtraci, hygienu, mikroklima, ekologickou rozmanitost, tepelnou regulaci a estetickou hodnotu v univerzitním kampusu. Kromě toho budou části louky využívány pro výukové a výzkumné účely. Cílem projektu je zvýšit povědomí, podpořit ekologické uvědomění, prosazovat udržitelná řešení a demonstrovat je v praxi.

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